MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

BMT 1014 – MANAGERIAL MATHEMATICS
(All Sections / Groups)

14 MARCH 2020
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 6 pages, including a list of formulae.
2. Attempt all 4 questions. The distribution of marks for each question is given.
3. Students are allowed to use scientific calculators.
4. Please write your answers in the **Answer Booklet** provided.

Question 1 [Total = 25 marks]

a) Symphony Products manufactures two high-quality musical instruments, violin and guitar units. Its profit is \$300 per violin and \$420 per guitar unit. Next week's production will be constrained by two limited resources, labor and wood. The labor available next week is expected to be at most 930 hours and the amount of wood available is expected to be at most 2400 board feet. Each violin requires 4 labor hours and 8 board feet of wood. Each guitar unit requires 3 labor hours and 12 board feet of wood.

i) Formulate the linear programming problem to describe the situation to maximize the profit. [3 marks]

ii) Using graphical method, find how many violin and guitar units should be produced next week to maximize Symphony's profit. [7 marks]

iii) What is the maximum profit? [1 mark]

b) Given the two quadratic functions: $f(q) = -q^2 - 4q + 12$ and $g(q) = q + 6$, find the equilibrium point. [6 marks]

c) A manufacturer has a monthly fixed cost of \$60,000 and a production cost of \$10 for each unit produced. The product sells for \$15 per unit.

i) What are the cost, revenue and profit functions? [3 marks]

ii) Compute the profit (loss) corresponding to production levels of 14,000 units per month. [1 mark]

iii) Find the break-even point. [4 marks]

Continued.....

Question 2 [Total = 25 marks]

a) Maggie wishes to make three-year loan and can afford payments of RM50 at the end of each month. If interest is at 12% compounded monthly, how much can she afford to borrow? [5 marks]

b) A company establishes a sinking fund for plant retooling in 6 years at an estimated cost of $850,000.

i) How much should be invested semiannually into an account paying 8.76% compounded semiannually? [5 marks]

ii) How much interest will the account earn in the 6 years? [2 marks]

c) David's parents are considering a RM75,000, 30-year mortgage to purchase a new home. The bank at which they have done business for many years offers a rate of 7.54% compounded quarterly. A competitor is offering 6.87% compounded monthly. Would it be worthwhile for David's parents to switch banks? [13 marks]

Continued.....

Question 3 **[Total =25 marks]**

a) Find the derivatives of the following function:

(i) $y = 2x^{3/7} - \dfrac{5}{\sqrt{x}}$ [3 marks]

(ii) $y = \dfrac{e^{2x}}{x+3}$ [4 marks]

(iii) $y = x^3(1-3x)^{\frac{1}{4}}$ [4 marks]

b) Suppose that demand for a service is given by

$$p = 80 - 0.4x$$

where p is the monthly price in dollars and x is the number of subscribers.

(i) Find the total revenue as a function of the number of subscribers. [2 marks]

(ii) Find the marginal revenue when the price is $50 per month and interpret the result. [3 marks]

c) The productivity of a country Z is given by the function $f(x, y) = 10x^{\frac{3}{4}}y^{\frac{1}{4}}$

when x units of labor and y units of capital are used.

(i) What is the marginal productivity of labor and what is the marginal productivity of capital when the amounts expended on labor and capital are 288 units and 18 units, respectively? [8 marks]

(ii) Should the government encourage capital investment rather than increased expenditure on labor at this time in order to increase the country's productivity? [1 mark]

Continued.....

Question 4 **[Total = 25 marks]**

a) Solve the following integral:

(i) $\int x^{1/3} - \sqrt{x} + 4dx$ [4 marks]

(ii) $\int x^2 (x^3 + 2)^{10} dx$ [5 marks]

(ii) $\int_1^2 \frac{4x}{x^2 + 3} dx$ [7 marks]

b) For the function $L(x, y) = \frac{3}{2}x^2 + y^2 - 2x - 2y - 2xy + 68$

(i) Find the critical point(s). [6 marks]

(ii) Then use the second derivative test to classify the nature of the critical point(s). [3 marks]

End of page

Summary of Principal Formulas and Terms

Simple Interest

(i) Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)

(ii) Accumulated amount, $A = P(1 + rt)$

Compound Interest

(i) Accumulated amount, $A = P(1+i)^n$, where $i = \frac{r}{m}$, and $n = mt$

(m = number of conversion periods per year)

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

Effective Rate of Interest

$$r_{eff} = \left[1 + \frac{r}{m}\right]^n - 1$$

Future Value of an Annuity

$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$

(S = future value of ordinary annuity of n payments of R dollars periodic payment)

Present Value of an Annuity

$$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$

(P = present value of ordinary annuity of n payments of R dollars periodic payment)

Amortization Formula

$$R = \frac{Pi}{1-(1+i)^{-n}}$$

(R = periodic payment on a loan of P dollars to be amortized over n periods)

Sinking Fund Formula

$$R = \frac{Si}{(1+i)^n - 1}$$

(R = periodic payment required to accumulate S dollars over n periods)

Basic Rules of Differentiation

a) Product rule: $\frac{d}{dx}[f(x)g(x)] = f(x)g'(x) + g(x)f'(x)$

b) Quotient rule: $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$

c) Chain rule: $g[f(x)] = g'[f(x)]f'(x)$

d) General Power rule: $\frac{d}{dx}\left[f(x)^n\right] = nf(x)^{n-1}f'(x)$

e) Logarithmic function: $\frac{d}{dx}(\ln u) = \frac{1}{u}\left(\frac{du}{dx}\right)$

f) Exponential function: $\frac{d}{dx}\left(e^u\right) = e^u\frac{du}{dx}$

Basic Rules of Integration

a) Logarithmic function: $\int \frac{1}{u}\,du = \ln u + C$

b) Exponential function: $\int e^u\,du = e^u + C$

Determining Relative Extrema

$$D(x,y) = f_{xx}f_{yy} - (f_{xy})^2$$

If $D > 0$ and $f_{xx} > 0$, relative minimum point occurs at (x, y)
If $D > 0$ and $f_{xx} < 0$, relative maximum point occurs at (x, y)
If $D < 0$, (x, y) is neither maximum nor minimum point
If $D = 0$, the test is inconclusive